https://doi.org/10.48047/AFJBS.6.6.2024.5799-5803

African Journal of Biological Sciences

A Study On Morphometric Analysis Of Bregma And Lambda And Presence Of Sutural Bones.

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Article Info

Volume 6, Issue 6, June 2024

Received: 23 April 2024

Accepted: 26 May 2024

doi: 10.48047/AFJBS.6.1.2024.5799-5803

Abstract

Background: The bregma is the anatomical point on the skull at which the coronal suture is intersected perpendicularly by the sagittal suture. The bregma is located at the intersection of the coronal suture and the sagittal suture on the superior middle portion of the calvaria. It is the point where the frontal bone and the two parietal bones meet. The bregma is known as the anterior fontanelle during infancy. The anterior fontanelle is membranous and closes in the first 18-36 months of life. The posterior fontanelle is a gap between bones in the human skull, triangular in form and situated at the junction of the sagittal suture and lambdoidal suture. It generally closes in 6-8 weeks from birth. The cranial point in adults corresponding the fontanelle is called lambda. A delay in closure is associated with congenital hypothyroidism.

Materials and Methods: The present study conducted with 96 adult dry skull. We measured the distance between bregma and lambda. The measurements were carried out by Digital Vernier callipers scale with a precision of 0.1 mm. The data was expressed in Mean+SD. We also observed for presence of sutural bones at bregma and lambda.

Result: The mean bregma-lambda length was found to be 112.34+8.34 mm, in case of males it was found 116.82+9.26mm and in case of females it was 107.86+6.12mm. The range was found in total 103 - 126mm, in case of males the range was 106-126mm and in case of female it was 101-117mm. we found in a skull sutural bone at bregma and in 15(15.62%) skulls we found sutural bones at lambda.

Conclusion: Knowledge of variations and characteristics of skull is important for forensic medicine, anatomy, radiology and neurosurgery. Landmarks such as bregma, lambda continue to be indispensable for the neurosurgeon and their information plays a important role.

Keywords: Bregma, Lambda, Sutural bones, anterior fontanelle.

Introduction

At birth, the newborn's skull consists of five major bones, two frontal, two parietal, and one occipital, that are separated by connective tissue junctions known as cranial sutures. The sutures function as seams, and they are highly necessary to facilitate the movement and moulding of the cranium through the birth canal during labor. They also allow for rapid postnatal growth and development of the brain. However, the bones that shape the cranium begin unfused, leaving several gaps between the individual bones of the infant's skull. These gaps are composed of membranous connective tissue

and are known as fontanelles. Six fontanelles are present during infancy, with the most notable being the anterior and posterior fontanelles. Fontanelle morphology may vary between infants, but characteristically they are flat and firm.

The anterior fontanelle is the largest of the six fontanelles, and it resembles a diamond-shape ranging in size from 0.6 cm to 3.6 cm with a mean of 2.1 cm. It forms through the juxtaposition of the frontal bones and parietal bones with the superior sagittal sinus coursing beneath it. The parietal bones are positioned against each other to complete the fontanelle. The positioning of the two parietal bones against each other gives rise to the sagittal suture. The average closure time of the anterior fontanelle ranges from 13 to 24 months. The posterior fontanelle or occipital fontanelle is the triangular soft membranous gap at the junction of the lambdoid and sagittal sutures. It persists until approximately 2-3 months after birth, after which it is known as the lambda. Unlike the anterior fontanelle, the posterior fontanelle is triangular and completely closes within about six to eight weeks after birth. This structure arises from the juncture of the parietal lobes and occipital lobe. Through this placement, the lambdoid suture forms. It can be used as an additional sonographic window for performing cranial ultrasound to improve visualization of dependently layering intraventricular haemorrhage. In neurosurgery, it is important to know where in the brain a surgical intervention will take place. Ideally, the skull should remain as together as possible, so drilling a small hole is preferable. There are two major anatomical markers on the dorsal surface of the brain that are formed when the plates of the skull fuse during development, and these markers are used to identify the location of various anatomical structures of the brain. The anterior most marker is called bregma. Bregma is the spot where three cranial plates, the frontal bone and the two parietal bones meet. The more posterior marker is called lambda. Lambda is the upside-down, broad V-shaped point that is indicated by the intersection between the sagittal suture and curved lambdoid suture [1,2,3,4,5,6]. The present study was conducted to find out morphometric analysis and presence of sutural bones at bregma and lambda.

Materials and Methods

The present study conducted with 96 adult dry skull, which were collected from departments of Anatomy of multiple medical and dental inistitutions. All the skulls were examined carefully and identified the gender and separated, we found 52 skulls as male and sides 44 skulls as female. We have observed bregma and lamda suture of all the skulls carefylly to findout the sutural bones and taken measurement bet ween bregma and lambda and noted. The damaged skulls were excluded, the skulls which were shown clear suture and neatly presented were only selected for the study. The measurements were carried out by Digital Vernier callipers scale with a precision of 0.1 mm. Each dimension was measured thrice and the mean figure recorded. The data collected was checked for errors prior to analysis.

Result

We measured the length between bregma and lambda, the mean bregma-lambda length was found to be 112.34+8.34 mm, in case of males it was found 116.82+9.26mm and in case of females it was 107.86+6.12mm. The range was found in total 103 – 126mm, in case of males the range was 106-126mm and in case of female it was 101-117mm. we found in a skull sutural bone at bregma and in 15(15.62%) skulls we found sutural bones at lambda (Figure 1).

Figure 1. Skulls showing sutural bones at bregma and lambda.

Discussion

The traditional definition of wormian bones is small bones that are often found within the sutures and fontanelles of the skull. Some instances are often considered to be a simple anatomical variant. Previous studies concluded that around 8%–15% of the population has at least one wormian bone. In patients with significant pathologies, there are least ten wormian bones larger than around 6 mm × 4 mm arranged in a mosaic-type pattern. The skull itself is composed of several flat bones that fuse together after birth. These sites of fusion are the bony sutures in which wormian bones most commonly occur. Wormian bones are more commonly seen in patients with several types of bone dysplasia. Osteogenesis imperfecta is the most common type of bone dysplasia, in which wormian bones represent one of the main diagnostic features. Wormian bones can be also encountered in a long list of heritable syndromes [7,8,9].

In present study we measured the length between bregma and lambda, the mean bregma-lambda length was found to be 112.34+8.34 mm, in case of males it was found 116.82+9.26mm and in case of females it was 107.86+6.12mm. In study of Joshi, A et al [10] Bregma-lambda length was studied in hundred skulls of unknown sex and reported the mean bregma-lambda length was 108.67+5.07 mm ranging between 101 - 126 mm. The calculated range of mean ± 3SD was 108.67±130.32 mm respectively. The study by Keen et al[11] with 50 skulls, they reported Bregma-lambda length was 126.5 mm with a range of 112-136 having standard deviation of 6.7 mm. B M Margretts[12] conducted study with 70 skulls found the mean of 128.39 mm with a range of 114-144 mm having standard deviation 6.76 mm. The study of Hong wei Song[13] with sample size 30 found mean to be 124.4 mm having standard deviation of 9.8 mm. Deshmukh et al[14] study with 40 skulls, reported the distance between begma and lambda was 125+7.96mm, with 108-135 mm. Narsimhamurthy S et al[15] study conducted with 50 skulls reported the mean distance between bregma and lambda as 124.12+7.42mm and range was 112-136 mm.,

In present study we found in a skull sutural bone at bregma and in 15(15.62%) skulls we found sutural bones at lambda. In study of Joshi A et al [10] with 100 skulls of unknown sex for presence of any wormian bone in bregma and it was found that there is complete absence of any wormian bone in bregma. Goyal N [16] study with 147 skulls found the incidence of sutural bones found in

52 skulls (35.3%), with males having 23.8% and females having 11.5% and the highest number of sutural bones was observed at the lambdoid suture. They concluded that there is no association of the presence of sutural bones in males to the females. In study by Ghosh SK et al [17] in India's eastern region on 120 unknown adult skulls found the incidence of sutural bones being 45%. The maximum incidence of sutural bones was also observed in lambdoid suture. The Turkey-based study conducted with 300 skulls and found 9% having sutural bones, with maximum incidence at lambdoid[18]. In another study in West Anatolian Population on 150 skulls, rate of skulls with sutural bones were found as 59.3%. The left lambdoid suture was having maximum rates of suture having sutural bones as 40.7%[19].

Conclusion

The knowledge of sutural bones, their incidence and features are helpful for the surgeons to arrive at an early diagnosis and timely management of disorders associated with it. The knowledge of sutural bones in the skull is also helpful to radiologists, forensic experts in successfully differentiating a skull fracture from normal suture with sutural bones.

References

1. Lall N, Hacking C, Knipe H, et al. Posterior fontanelle. Reference article, Radiopaedia.org (Accessed on 16 Mar 2024) https://doi.org/10.53347/rID-62360).
2. Saheb HS, Mavishetter GF, Thomas ST, Prasanna LC, Muralidhar P. Occipitalization of Atlas: A case report. J. Biomedsci and Res. 2010;2:73-75.
3. Lipsett BJ, Reddy V, Steanson K. Anatomy, Head and Neck: Fontanelles. [Updated 2023 Jul 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK542197/
4. D'Antoni AV, Donaldson OI, Schmidt C, Macchi V, De Caro R, Oskouian RJ, Loukas M, Shane Tubbs R. A comprehensive review of the anterior fontanelle: embryology, anatomy, and clinical considerations. Childs Nerv Syst. 2017 Jun;33(6):909-914.
5. Hussain Saheb S, Haseena S, Prassana LC. Unusualwormian bones at Pterion-Three Case Reports. J Biomed Sci and Res. 2010;2:116-8.
6. What are bregma and lambda?. Anatomy, Clinical, Experimental methods. December 2, 2019. (Accessed on 16 Apr 2024.) https://brainstuff.org/blog/what-are-bregma-and-lambda-neuroanatomy-brain-skull.
7. Al Kaissi A, Ryabykh S, Ben Chehida F, Al Kaissi H, Kircher SG, Stransky MJ, Grill F. The Tomographic Study and the Phenotype of Wormian Bones. Diagnostics (Basel). 2023 Feb 24;13(5):874. doi: 10.3390/diagnostics13050874. PMID: 36900016; PMCID: PMC10000840.
8. Bellary S.S., Steinberg A., Mirzayan N., Shirak M., Tubbs R.S., Cohen-Gadol A.A., Loukas M. Wormian bones: A review. Clin. Anat. 2013;26:922-927. doi: 10.1002/ca.22262.
9. Cirpan S., Asku F., Mas N. The incidence and topographic distribution of sutures including wormian bones in human skulls. J. Craniofac. Surg. 2015;26:1687-1690. doi: 10.1097/SCS.0000000000001933.
10. Joshi, A., Yadav, Y., Verma, R., Kaul, N. V., & Vineel, P. (2022). Morphometric analysis of bregma and lambda and presence of any Wormian bone in bregma in north Indian population. International Journal of Health Sciences, 6(S6), 11381-11385. https://doi.org/10.53730/ijhs.v6nS6.13152
11. Keen JA; Sex differences in skull. APJA,1950;8(1):65-79.

12. Margretts BM, Freedman L;Morphometrics of western Australian aboriginal skulls. Rec West Aust Mus., 1977; 6(1): 63-105.
13. Song HW, Lin ZQ, Jia JT; Sex diagnosis of Chinese skulls using multiple stepwise discriminant functional analysis. Forensic Sci Int., 1992;54(2):135- 140.
14. Deshmukh AG, Devershi DB; Comparison of cranial sex determination by univariate and multivariate analysis. Joint Anatomy Society of India, 2006;55(2):48-51.
15. Narasimhamurthy S, Dileep Kumar R, Manjunath T. H., Nagesh Kuppast, Umesh S R, Shradha Iddalgave Sch. J. App. Med. Sci., 2015; 3(3F):1467- 1470
16. Goyal N, Garg A, Kumar Y. Incidence and Medicolegal Significance of Wormian Bones in Human Skulls in North India Region. Int J Appl Basic Med Res. 2019 Jul-Sep;9(3):165-168. doi: 10.4103/ijabmr.IJABMR_89_19. PMID: 31392180; PMCID: PMC6652277.
17. Ghosh SK, Biswas S, Sharma S, Chakraborty S. An anatomical study of wormian bones from the eastern part of India: Is genetic influence a primary determinant of their morphogenesis? *Anat Sci Int.* 2017;92:373-82.
18. Govsa F, Ozer MA, Bayraktaroglu S, Aktas EO. Anatomoradiological identification of intrasutural bones for importance of cranial fracture. Turk Neurosurg. 2014;24:357-62.